AP STAT: Section 1.3

Other Distributions (using mean and std. deviation)

Histogram/stemplot/etc.

- samples
- actual observations
- different graphs
- calculate:

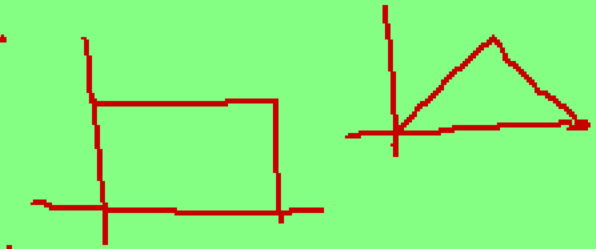
$\left.\begin{array}{l}\bar{x}\\ s\end{array}\right\}$ sample

$N(\mu,\sigma)$

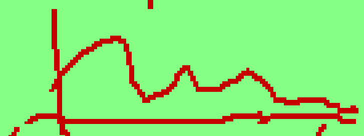
$N(75,7)$

Density Curve

- different forms



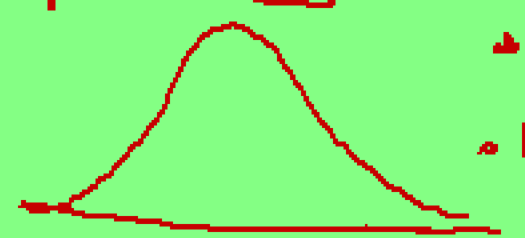
- population



- show overall/general pattern
- smooth curve
- relative freq. (%)
- area under curve = 1 = 100%

Specific Density Curve:

* NORMAL CURVE (or DISTRIBUTION)



- symmetric
- bell-shaped mounded
- unimodal

Ex: ht, weights, test scores

Empirical Rule

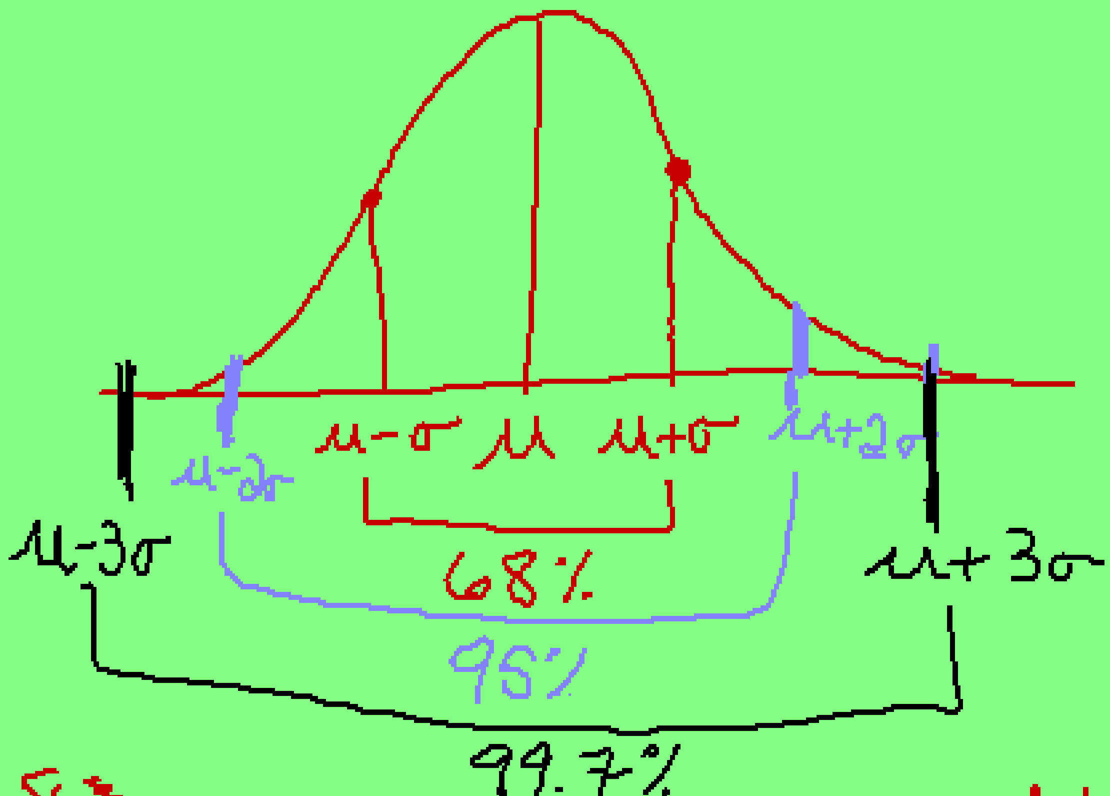
In a normal distribution with N(μ, σ)....

N(15, 3)

(12, 18)

(9, 21)

(15, 18)



- 68 % of the observations fall within $\mu \pm \sigma$
- 95 % of the observations fall within $\mu \pm 2\sigma$
- 99.7 % of the observations fall within $\mu \pm 3\sigma$

Example:

The avg. time that it takes a crew from Sweeper Sam to clean a room is normally distributed with a mean of 2.1 hrs and a standard deviation of 0.3 hrs.

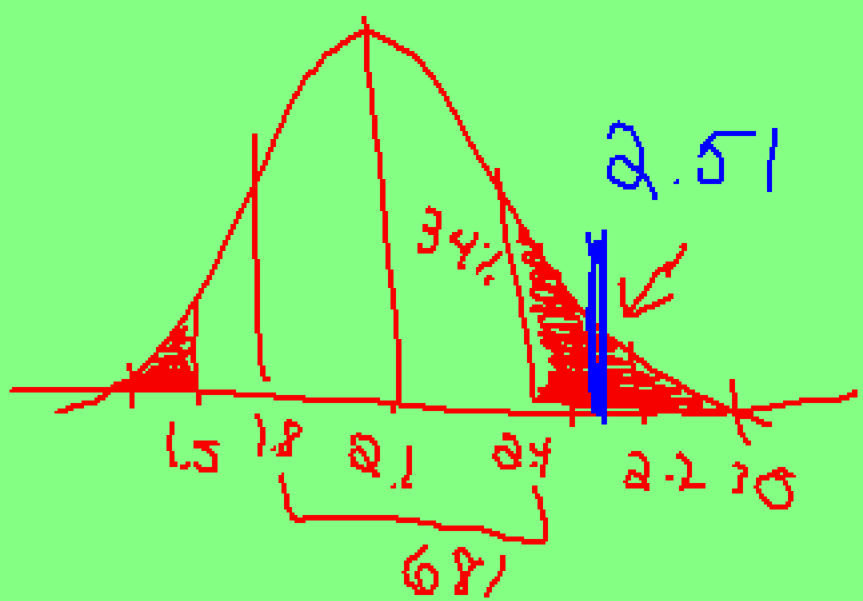
a) The total clean up time will fall within what interval 95% of the time? $\pm 2\sigma$

$N(2.1, 0.3)$ $\quad \mu \pm 2\sigma = 2.1 \pm 2(0.3) = (1.5, 2.7)$ hrs

b) What proportion of the time will it take the crew 2.5 hours or more?

16%

c) What percent of the time will it take the crew 1.5 hrs or less?



Standardizing Observations

1) You are in a history class and a math class. You take your chapter 1 test in both classes on the same day, and get them both back a few days later. Your grades are as follows. Which class did you do better in?

History: 81% *Math: 75%*

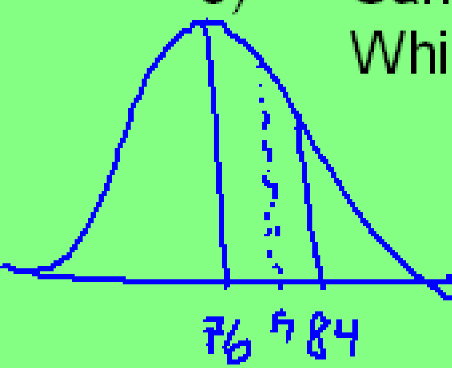
2) Same scenario. However, each teacher tells you a bit about how your class did. Which class did you do better in?

same

History:
mean: 76%

Math:
mean:70%

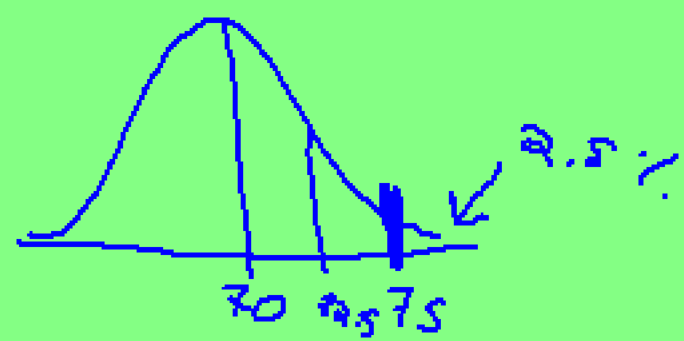
3) Same scenario. However how your teacher gives you the class standard deviations. Which class did you do better in?



0.7σ $<1\sigma$

History:
std. dev: 8%

Math:
std. dev:2.5%



2σ

Standardizing Observations

Question: *How can we compare one distribution to another distribution if they don't have the same parameters (mean and std. dev)?*

Answer: compare the observation to its mean and std. dev.

To standardize:

- *measure observations....* in terms of how far it is above / below its μ.
- Z = z-score = $\frac{x - \mu}{\sigma}$ (obs.)
- *Z- score tells us...* how many σ that obs. is above/below its μ

$z = 1.3$ = the obs. is 1.3σ above its μ.

-2.1

Example: *The heights of 18-24 year old women are normally distributed with the following:*

mean = 64.5" and std. dev = 2.5" $N(64.5, 2.5)$

We know a woman who is 69" tall. How does she compare to the rest of the women in her age group? Calculate her z score, and interpret what it means.

$$z = \frac{x - \mu}{\sigma} = \frac{69 - 64.5}{2.5} = 1.8$$

1.8σ above her μ

Man: 69" tall $N(67, 2.1)$

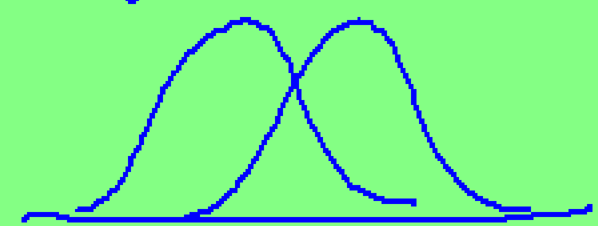
$$z = \frac{69 - 67}{2.1} = 0.95$$

Notes on Standardizing a distribution:

- Standardizing one observation… compare it to its mean
- But we can also standardize… a whole distribution by comparing the whole distr. to its mean & std. dev.

$$z = \frac{x - \mu}{\sigma}$$

- But what does this do to the shape of the distribution?



doesn't change

- Standardizing is actually just…

– changing the units

– manipulating the data

- When we do this we have a new distribution, called: Standard Normal Distrib.

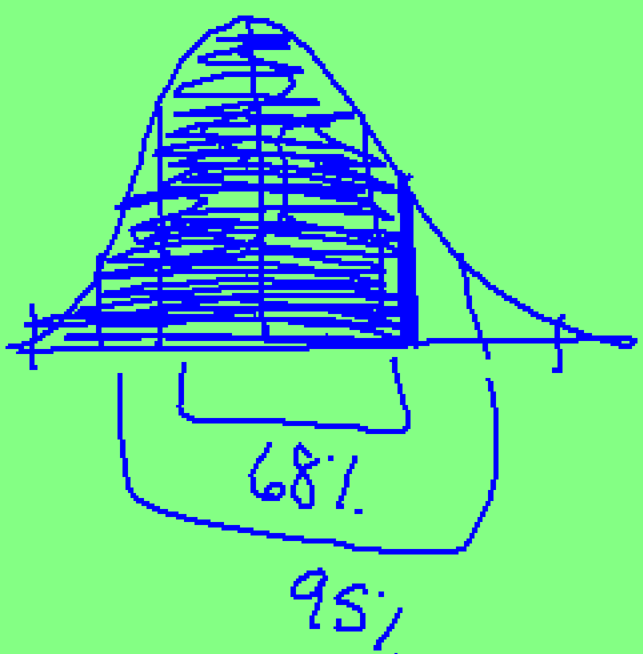
T-2 and T-3

- Table A in the book
  - Gives: prob. (%, prop, area) of data below a certain z-score

$z = 1.3$

  - So, the area to the left of the z-score represents…

% of the data below = percentile



$z = 1.34$

Back to the height example….

Remember that the heights of 18-24 year old women are N(64.5”, 2.5”). What percentile is the girl who is 68” tall?

What percent of 18-24 year old women are less than 5 feet tall?

What percent 18-24 year old of women are over 5'8” tall?

*** **PROBABILITY NOTATION!!***

Another example:

Blood pressures of high school students are N(170, 30). What is the probability that a randomly selected high school student has a blood pressure of 180 or above?

Using the same data as above, what is the probability that a high school student has a blood pressure between 160 and 230?

Using the same data as above, what blood pressure has 25% of the bobservations below it?

Calculator use:

To find the percent of observations between 2 points:

normalcdf(lower bound, upper bound, μ, σ)

a b

$P(a < X < b)$

To find what observation has a certain percent of the data below it:

invnorm(prop. below, μ, σ)

On the calculator, infinity is: $P(X > 180)$ $P(180 < X < \text{inf.})$

E99

$-\infty = -E99$